Barriers for flexibility in the district heating-electricity interface

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Publication date:
2016

Document Version
Peer reviewed version

Flex4RES
Flexible Nordic Energy Systems

DTU

Barriers for flexibility in the district heating-electricity interface

International Energy Conference

ENERGY EFFICIENCY DIRECTIONS IN
THE NORDIC COUNTRIES AND LITHUANIA,
December 2016

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Motivation - Flex4RES

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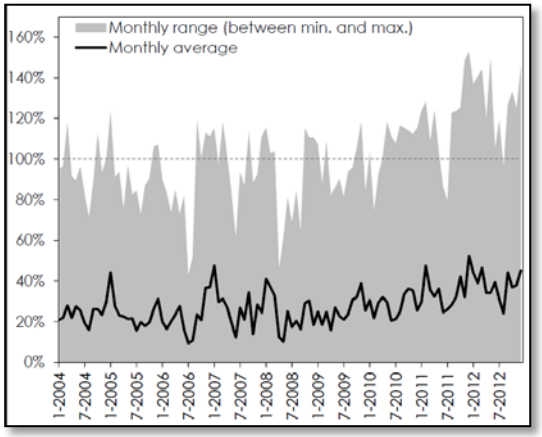
- The new electricity systems: From centralised and fossil-intensive systems to sustainable and integrated
- Increasing shares of variable renewable energies (VRE)

Wind production share in DK-West



- Integration costs expected to increase
  Need of more ***flexibility***

- ***Potentials and technological solutions exist*** - both
  - locally in the power market,
  - from other regions through the transmission lines, or
  - by coupling to the **heat**, gas or transport sectors, or even storage facilities.

- Need for
  - **REthinking of the framework conditions**

    Why are the potentials not used today? Barriers/drivers

Hypotheses

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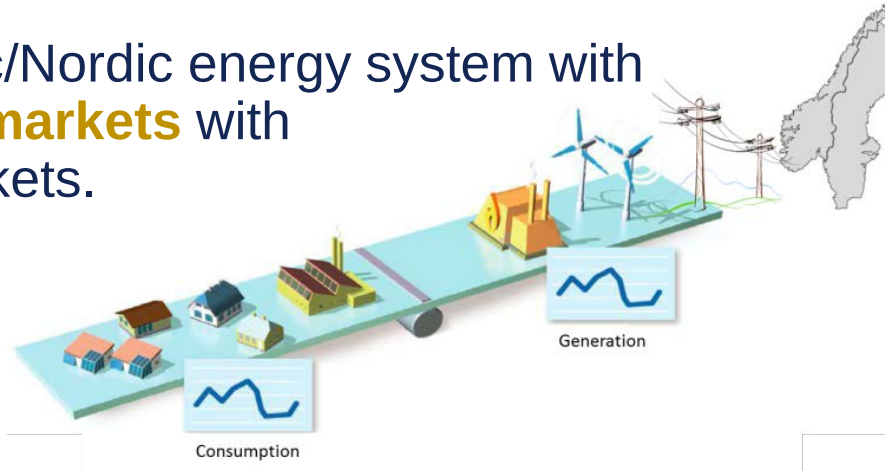
Comparative advantages of combining different energy markets, both with respect to flexibility, but also with respect to synergy and economics.

The Baltic/Nordic power market is well functioning despite a few technical challenges.

With the right coupling to the underlying national and local energy markets for heat, gas, and transport fuels, enough flexibility can be generated in a cost efficient way and so embrace a larger amount of VRE.

Holistic system approach to the Baltic/Nordic energy system with **flexibility obtained across energy markets** with respect to flexibility at the power markets.



Integrated Coherent Energy Systems

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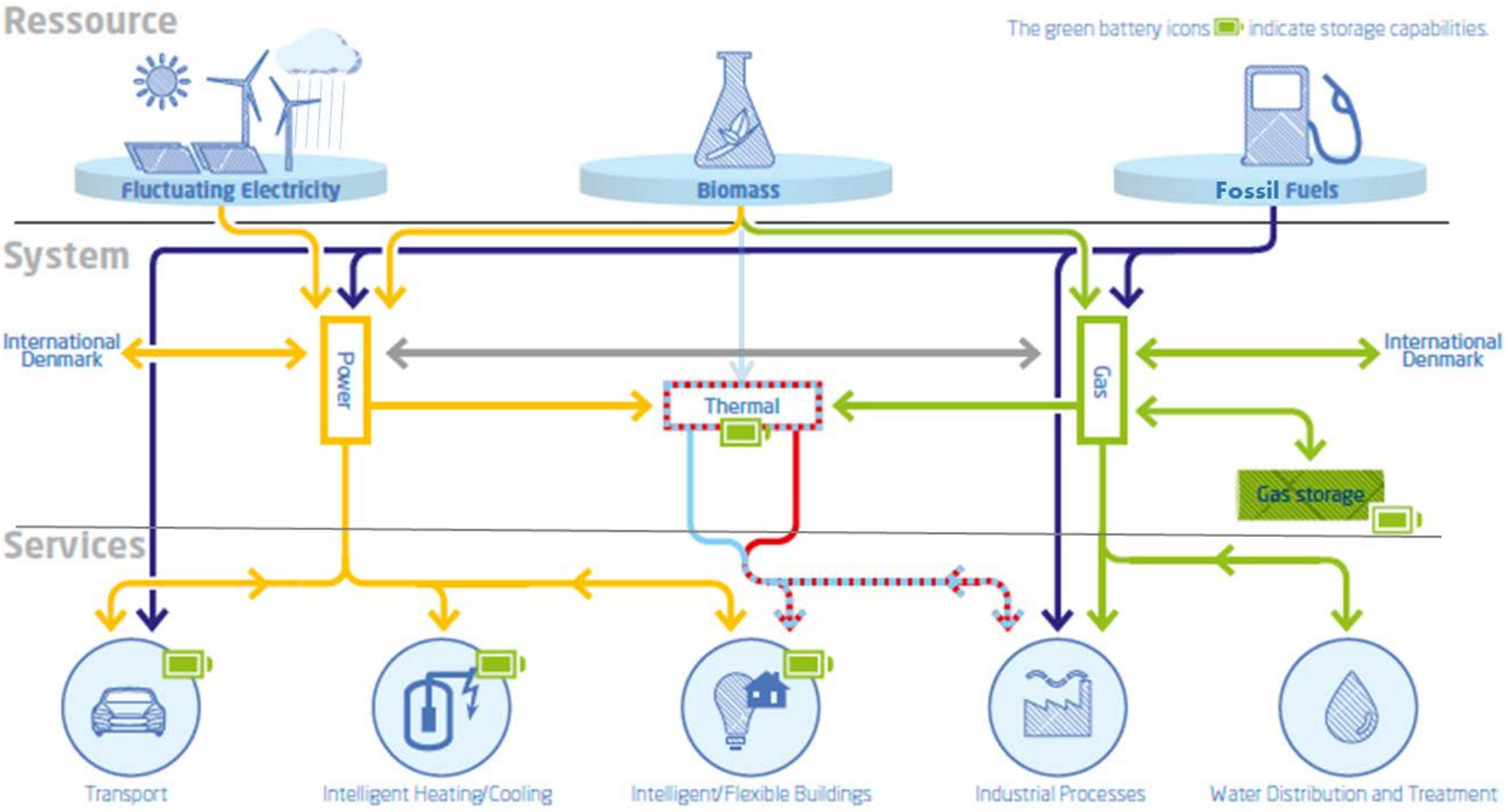
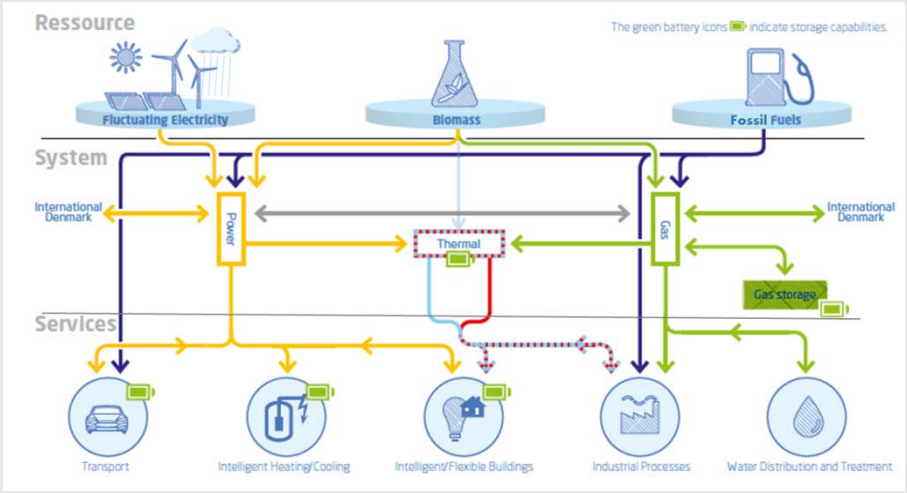
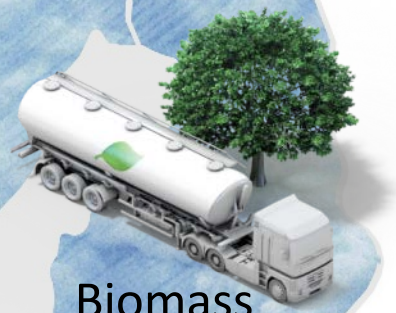


Challenges in a larger perspective



Energy system integration

Infrastructure



Biomass Supply

Energy Efficiency

CCS

Regulation & market design

Outline of the talk today

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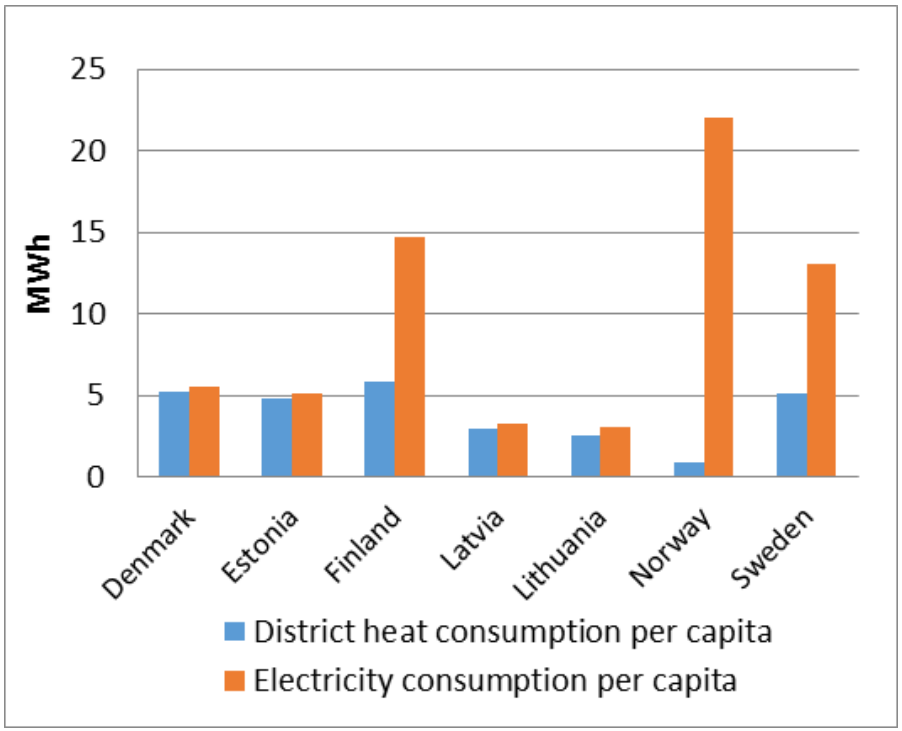
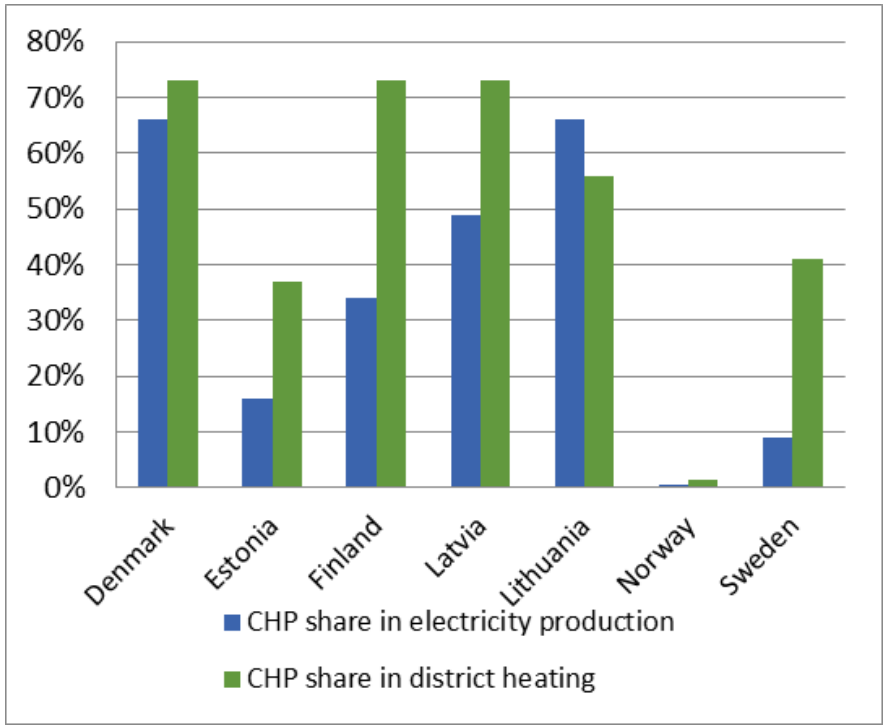
- District heating-electricity interface
- Barriers for flexibility
- Discussion

District Heating in the Baltics/Nordics





Source: Euroheat, 2015

District heating is widely used in most Baltic/Nordic countries and thus represents a flexibility source of considerable magnitude which is only partly exploited today by the power market

Which technologies can provide flexibility?

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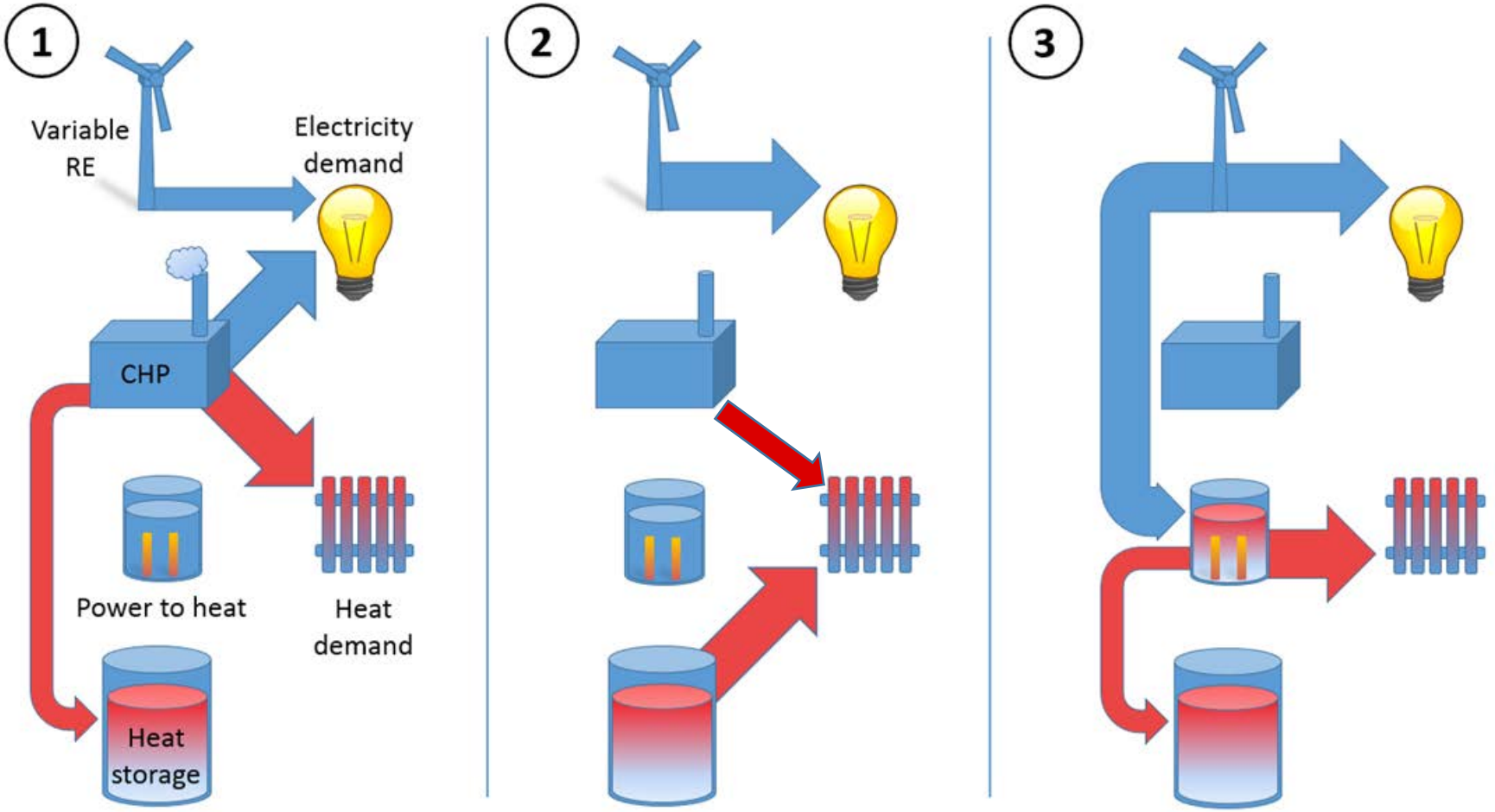
Today flexibility is mainly provided by CHP combined with heat storages (water tanks)

- Water tanks are widely installed and used in Denmark, Finland and Sweden

Electric boilers and large heat pumps

- Several barriers, e.g. existing taxation
- Consequently: very limited use in the Baltic/Nordic countries

District heating-electricity interface



Power demand exceeds the VRE supply

No need for additional flexibility

VRE power supply exceeds the demand

Different market frameworks

The Baltic/Nordic power market is an integrated competitive market

DH is supplied by local monopolies regulated by national rules and authorities

- Not designed to provide integration with the power market
- National rules sometimes work against DH providing flexibility services to the power market

Barriers to flexibility

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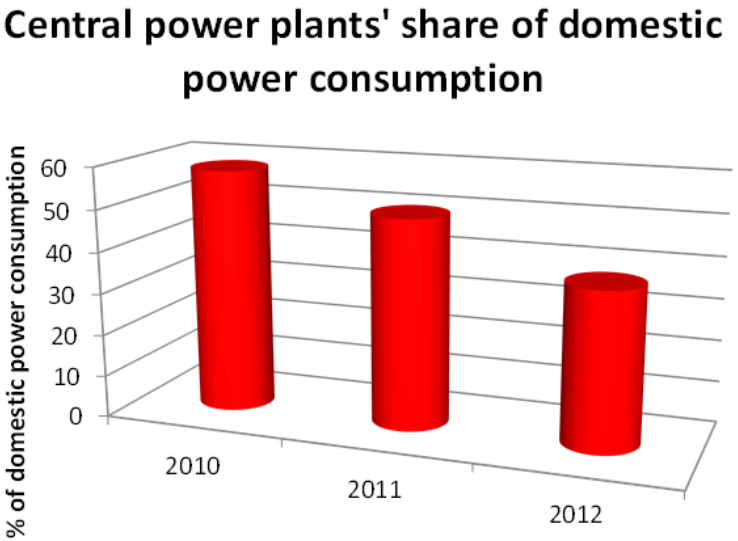
Market development, e.g.

- Large central power plants run fewer and fewer hours due to low electricity prices
- No incentives to investment in flexible capacity



Regulatory set up, e.g.

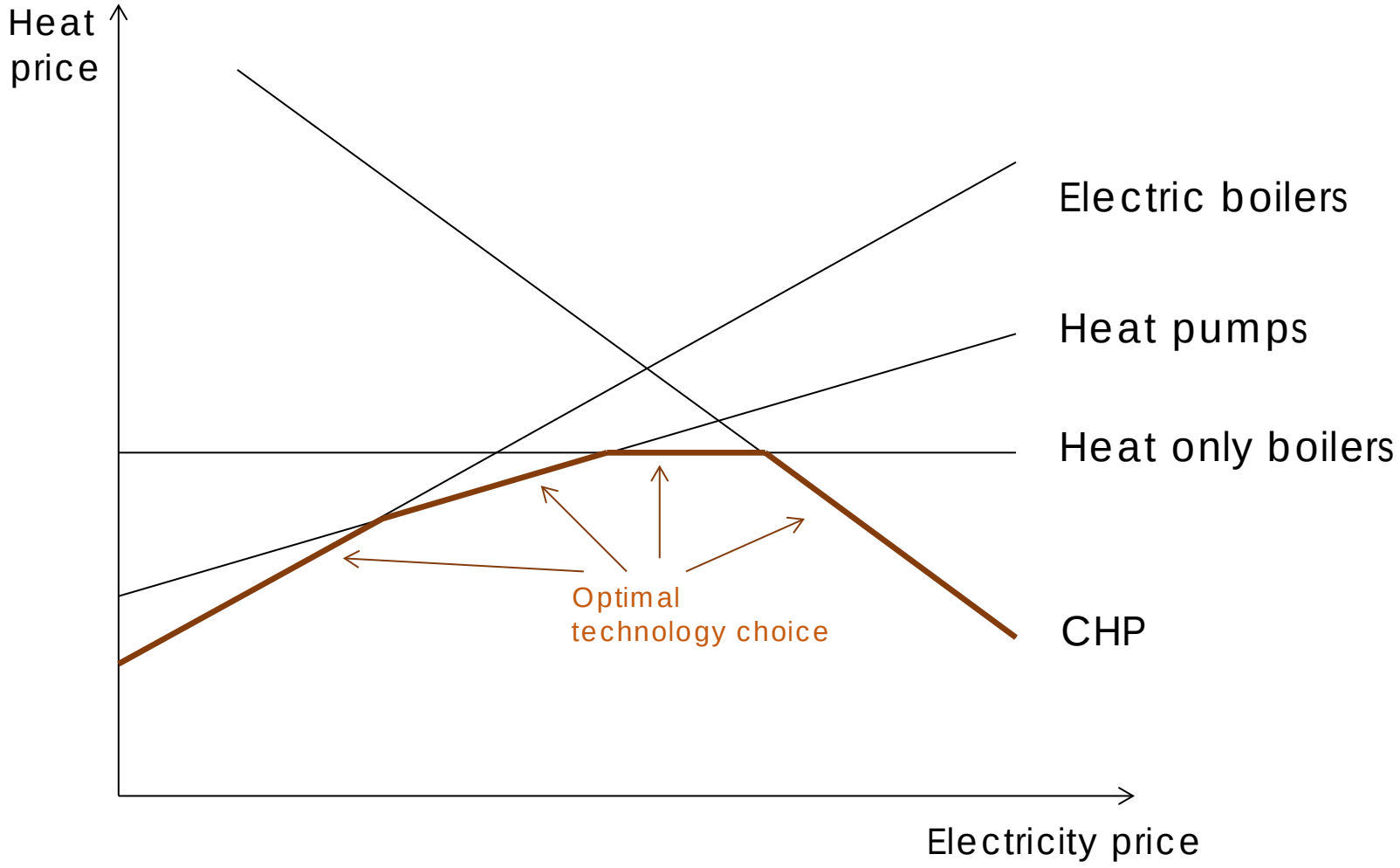
- grid tariffs and taxes on electricity use
- local DH utilities prefer to substitute gas-fired CHP by biomass heat-only boilers due to tax exemptions for biomass

Baltics:

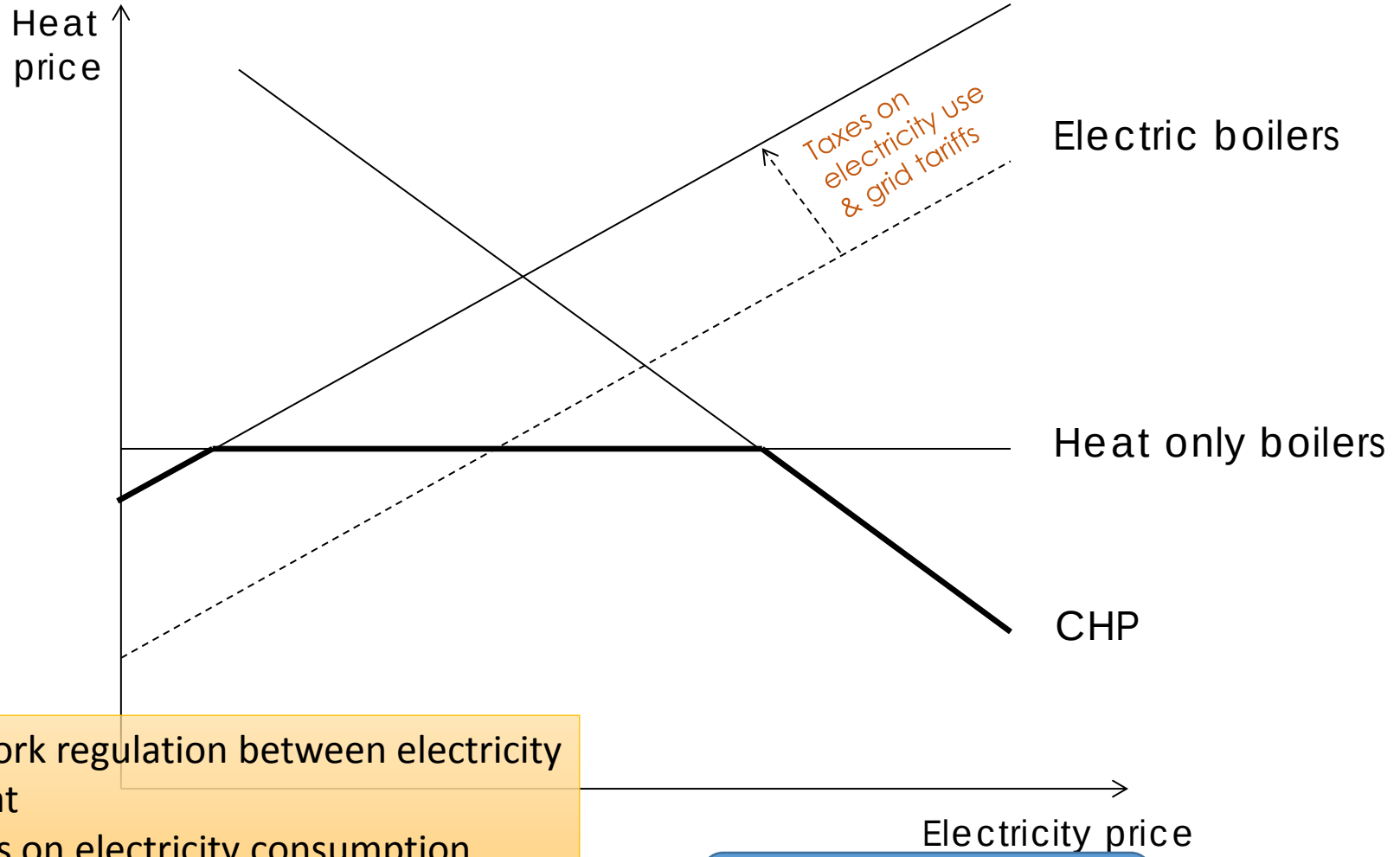
Limited use of

- market prices for CHP
- thermal storages/water tanks

Choice of heat supply - different el prices net costs



Choice of heat supply - at different electricity prices



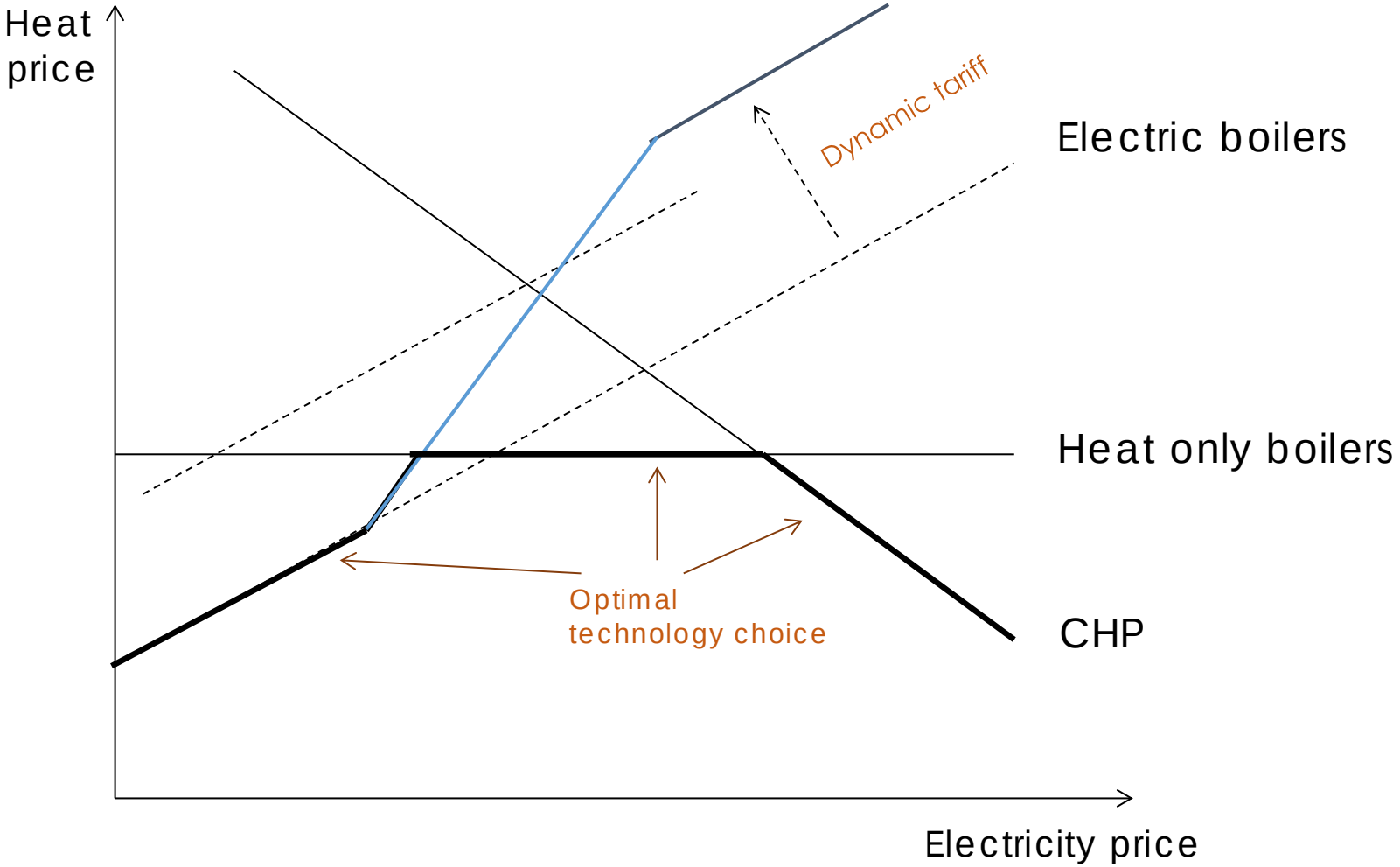
Patchwork regulation between electricity and heat

- Taxes on electricity consumption
- Heat is taxed at the fuel input
- Biomass exempted for taxes

More heat only boilers. Decoupling of electricity and heat markets

Choice of heat supply

With dynamic tariffs



Summing up

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- Trend towards more ***market integration*** and need for more ***flexibility***
- Large potentials in district heating

- Need for a holistic system approach in order to identify and assess ***regulatory and technical pathways*** towards coherent energy systems

REthink market designs and regulation

- Make RE market ready & Markets RE ready

- Coherent changes in market designs, regulatory framework condition, and coupling of markets
- Dynamic tariffs and taxes?

Thank you for your interest

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Questions ?

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